

SCATTERING AND RADIATION FROM ANISOTROPIC, LOSSY BODIES OF Revolution

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Development of hybrid methods that combine the benefits of the finite element method with those of integral equation techniques is allowing the analysis of more complicated objects. Specifically, it has recently been shown that these methods can be applied to bodies of revolution such that the resulting system matrix is complex and symmetric. The resulting system is well conditioned and diagonally dominant. In addition the computational boundary can be placed on the scattering object in a manner similar to integral equation solutions.

The advantage of the extra work in formulating a so-called exact boundary condition comes when the outer boundary is placed on the object. This minimizes the large number of unknowns associated with the finite element basis functions, but allows their use inside inhomogeneous, lossy objects. Lossy objects are easily handled by inclusion of complex permittivities. Of even more interest, anisotropic media can be handled without the need for complicated Green's functions or difficult modal expansions. In particular, this method has been applied to ferrite materials. Ferrites are of interest, due to the study of the quasi-optical ferrite circulator, for possible JPL/NASA Deep Space Network use. The method has been extended so that the scattering geometry can be illuminated by a Gaussian incident field. The Faraday rotation through the device can be found and the influence of the finite edge effects determined.

In order to study radiation from bodies of revolution it is necessary to modify the approach to include the sources that are internal to the computational boundary. Typically objects such as low gain antennas used in spacecraft communications have axisymmetric geometries. These antennas are often excited by cylindrical waveguide modes. The implementation of this method for radiating bodies of revolution will be discussed.

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